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A STUDY OF THE DEJECTA OF NORMAL CHILDREN AND OF THOSE SUFFERING FROM ACUTE AND SUBACUTE DIARRHEA WITH REFERENCE TO B. DYSENTERIAE.*

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UP to the present time, except in a limited number of cases, B. dysenteriae, though widely searched for, has not been found in the dejecta of normal individuals or those suffering from diseases other than dysentery.

Shiga,[1] Flexner,[2] Drigalski,[3] and others, after the examination of a large number of cases, chiefly adults, failed to demonstrate the presence of this organism in normal stools.

Duval[4] states that he found in two instances B. paradysenteriae of the Flexner-Harris type in the normal stools of milk fed infants.

Wollstein[5] in a series of 32 non-dysenteric infants, did not find B. dysenteriae in any instance. In 24 other cases examined at autopsy, B. paradysenteriae was found in the scrapings from the mucous membrane of the intestines three times. Two of these cases gave a history of previous attacks of diarrhea, while the third case had developed a terminal dysentery five days before death.

The term diarrhea is used wherever the exact nature of the attack was not ascertainable; while the term dysentery is used only in those cases where the organism was isolated. The term paradysentery is applied to the types which ferment mannite and differ in their agglutination reaction, but in all other respects correspond to the organism isolated by Shiga as the cause of dysentery.

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[1] *Centralbl. f. Bakt.*, 1898, 23, p. 599. *Ibid.*, 1898, 24, pp. 817, 870, 913. *Deutsche med. Woch.*, 1901, 27, pp. 741, 765, 783.

[2] *Studies from The Rockefeller Inst. of Med. Res.*, 1904, 2, p. 121.

[3] *Veröff. a. j. mil. Sanitätswesen*, 1902, 20, p. 86.

[4] *Studies from The Rockefeller Inst. of Med. Res.*, 1904, 2, p. 42.

[5] *Ibid.*, p. 193.

Charlton and Jehle,[1] working in the laboratory of St. Ann's Kinderhospital, Vienna, found, in apparently normal stools, B. paradysenteriae, Flexner-Manila type, present in two cases out of ten examined. These cases gave a negative history as to dysentery and diarrhea. The blood of the cases did not agglutinate the cultures obtained from the stools or the Flexner-Manila bacillus.

The following report comprises a study of 78 cases, of which 57 were children with normal stools and 21 were children suffering from acute or subacute diarrhea.

The first series of cases was undertaken during the months of March and April, 1903. At this time, a mild epidemic of dysentery existed in some of the wards at the Nursery and Child's Hospital, New York City. From the stools of several of these cases B. paradysenteriae, Park-Mt. Desert type, was isolated. In one case the organism was obtained from the stools before death and at autopsy from the mucous membrane of the lower colon. Thirteen infants having normal stools were selected from these infected wards for examination. In every instance the result was negative.

No special method was used to obtain the material for examination, plates being made as early as possible from the stools as normally passed.

During the month of August of the same year, coincident with the existence of dysentery in some of the wards, the study of normal stools was resumed. On this occasion the cases were taken from the reception ward where dysentery was, presumably, not present. The children examined were for the most part nurselings.

Two cases had had dysentery a few weeks previous to this time; from one case B. paradysenteriae had been isolated. At the time of the examination, both infants had recovered and the stools were normal. In neither case was B. paradysenteriae found. Seven of the remaining ten cases were also negative, while the tenth case was positive, giving the following history:

Case 1.—Age 24 months, nurseling, healthy. Had been in the reception ward three weeks; during this time the stools were normal and there was no history of diarrhea before entering the hospital. The child developed pneumonia three days after the stools were examined and the organism found. In the beginning of the attack there was a slight amount of mucus, but in every other respect the stools were normal and remained so throughout the course of the disease. The blood gave a good reaction in dilution of 1:10 with the Flexner-Manila organism.

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[1] *Trans. Assn. American Phys.*, 1904, 19, p. 405.

The organism isolated in this case in the proportion of one out of one hundred colonies possesses the following characteristics: Non-motile bacillus, ferments mannite and maltose without production of gas, does not produce gas on glucose or lactose, produces indol and nitrites, renders litmus milk slightly acid which later becomes alkaline. In the above features it corresponds to the Flexner-Manila type. In its agglutination reactions it resembles the Coney Island and Salant organisms which were isolated from cases of typical clinical dysentery.

A polyvalent dysenteric horse serum agglutinates this bacillus completely in the dilution of 1:500. It raises specific agglutinins in the animal body for itself and common agglutinins for other mannite fermenting types of the dysentery organism. The following table shows by the absorption tests its relation to the Coney Island and Salant cultures:

TABLE 1.

SERUM OF A HORSE INOCULATED WITH SHIGA, FLEXNER-MANILA, AND PARK-MT. DESERT TYPES OF B. DYSENTERIAE EXHAUSTED WITH THE CONEY ISLAND AND MT. DESERT TYPES.

Cultures	Serum before Exhaustion						Serum after Exhaustion with Coney Island Type						Serum after Exhaustion with Mt. Desert Type					
	20	50	100	200	500	1000	20	50	100	200	500	1000	20	50	100	200	500	1000
Japan—Shiga	++	++	++	++	++	++	++	++	++	++	++	−	++	++	++	++		
Manila—Flexner	++	++	++	++	++	++	++	++	++	++	++		++	++	++	++		
Mt. Desert—Park	−+	++	++	++	++	++	++	1					−	−				
Coney Island—Collins	++	++	++	++			−						++	++	−			
New York—Salant	++	++	++	++			−						++	++	−			
Normal—Collins	++	++	++	++			−						++	++	−			

++ Complete agglutination, 1 tendency, − negative.

In the above table the three last cultures exhibit a similar reaction after exhaustion. It is of interest to note that the production of common agglutinins for the Coney Island type is much less than for the Mt. Desert type.

In the above series of examinations the material was obtained by irrigation of the lower colon with sterile water. Plates were made from the first and last parts of the washing. From the latter, bits of mucus could readily be picked out. After withdrawal of the tube, the rectum was swabbed with sterile cotton and plates were made also from the swab.

The next study of 54 cases, obtained from several different sources, was made during the months of July, August, and September, 1904. Thirty-three of these cases were children with normal stools, and 21 were children suffering from acute or subacute diarrhea. In obtaining material for examination in these cases, I used the method devised by Dr. William H. Park. This consists of a blind glass tube with quite a good sized opening on the side. The tube is inserted into the rectum and the mucous surface, exposed through the opening in the side, is washed with sterile water. A cotton swab is then passed several times over the surface of the membrane; the swab is placed in a tube of broth and plates are made from this. A platinum loop was tried for scraping the mucous membrane, but it offered no advantage over the swab and was more irritating. In some cases irrigation of the lower colon supplemented the use of the tube, but as the use of the latter eliminated, to a very great extent, the gas producing organisms, it proved a more satisfactory method.

Of the normal cases examined, 17 were obtained through the courtesy of Dr. Reed from the Babies' Hospital, New York City. These were bottle fed babies ranging in age from three weeks to 21 months. Dysentery existed in the wards at this time, and some gave a past history of diarrhea, but, at the time of the examination, the stools were normal. In none of these 17 cases was B. dysenteriae or paradysenteriae found to be present.

Thirteen normal cases taken from the Foundling Hospital, New York City, were children ranging from two and a half to seven years of age, who had been in the wards where dysentery existed from three weeks to three years. Out of the 13 cases two were positive, the history being as follows:

Case 2.—Age 7 years. Eczema. Had been in the ward three years, and during that time there was no history of diarrhea. The stools were normal at the time of examination. The blood of the child reacted fairly in dilution of 1:20 with the Mt. Desert type of organism, but failed to show even a trace with the Shiga or Flexner-Manila type.

From the mucous surface of the rectum B. paradysenteriae, Mt. Desert type, was isolated. This organism agglutinated with a polyvalent dysenteric horse serum in the dilution of 1:500. With the Mt. Desert specific serum,* it agglutinated in the dilution of 1:200, which was the full agglutinating index of the serum, but failed to agglutinate with the Flexner-Manila or Shiga specific serum.

Case 3.—Age 3 years. Chronic conjunctivitis. One year in the ward, during which time there was no history of diarrhea. The stools were normal at the time. The blood in this case reacted feebly in dilution of 1:20 with the Flexner-Manila organism and not at all with the other types.

From the rectal mucous membrane B. paradysenteriae, Flexner-Manila type, was isolated in proportion of 1:50 of the colonies fished. It agglutinated with the polyvalent serum in the dilution of 1:500; with Flexner-Manila specific 1:100, and was negative with the specific sera of the other types.

During the past summer an epidemic of dysentery occurred in several districts, widely separated from each other, on Staten Island. Through the kindness of Dr. Walser and Dr. Patterson of Staten Island, the blood and stools from several of the dysenteric patients were obtained for examination and, as far as observed, only the Shiga type of organism prevailed.

From one of these infected neighborhoods where the sanitary surroundings were very poor three normal cases were taken under the following conditions:

Case A.—Age 7 years. No history of diarrhea. Three members of the family had had dysentery of the Shiga type. One case, in a child of three years, existed at the time of examination of the normal child, one adult case occurred three weeks previous, and one case two weeks later. Examination of the stools of the normal case was negative.

Cases B and C were taken from two children, two and five years of age, living directly oppposite to Case A. One child in this family, three years of age, had dysentery, Shiga type, at the time. The stools of the two normal children were negative.

The 21 cases of acute and subacute diarrhea were derived from the Babies' Hospital and the dispensaries of Bellevue Hospital and the German Polyclinic. The infants were bottle fed and were from six to eighteen months of age. The acute cases presented, in general, the following symptoms:

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*By specific serum is meant a polyvalent dysenteric serum from which all agglutinins have been absorbed except those for the one type.

The onset was sudden, with vomiting, rise of temperature, which was generally high, stools frequent, thin and watery in appearance and sometimes green and frothy. The prostration was marked and mortality high.

In the subacute cases the vomiting was absent, the rise of temperature moderate, if any, the stools thin and sometimes green, with some mucus but no blood; the emaciation was great.

In these cases, the contents of the colon were examined as well as the mucous surface of the rectum, and in no instance was B. dysenteriae found.

Charlton and Jehle[1] did not find the dysentery bacillus in the stools of children suffering from so called summer diarrhea, and Weaver[2] also failed to demonstrate it as the cause of the summer diarrhea of children.

The limited number of cases reported in which B. dysenteriae has been found in the stools of healthy individuals, or those suffering from disease other than dysentery, together with the fact that thus far the organism has not been found normally in adults, renders the interpretation of this phase of the subject difficult.

Flexner[3] has pointed out the advisability of questioning the nature of this organism as to its purely parasitic existence. Investigations along this line will aid greatly in determining the significance of the presence of the organism in the normal individual and in cases where the definite clinical symptoms of dysentery are absent.

Reasoning from analogy, we would readily assume that B. dysenteriae, like B. diphtheriae and the pneumococcus, may lead a harmless existence in the normal individual until a lowered vitality of the tissues invaded offers a suitable soil for the full development and elaboration of its toxines.

Wollstein[4] calls attention to the difficulty of obtaining reliable histories in the cases of children. This seems to be the experience generally of those who have to do with children. Very few infants, especially of the class generally found in dispensaries and hospitals, escape diarrhea in some form in the early months of life. Hence the finding of the organism under such conditions should not lead us into drawing too definite conclusions.

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[1] *Loc. cit.* [2] *Jour. Inf. Dis.*, 1905, 2, p. 81. [3] *Loc. cit.* [4] *Loc. cit.*

The failure to find B. dysenteriae or paradysenteriae in infants suffering from so called acute and subacute summer diarrhea, even though the symptoms were severe and repeated examinations were made, would lead us to suspect some cause or combination of causes other than this organism as the etiological factor in these conditions.

I desire to express my gratitude to Dr. William H. Park, Director of the Research Laboratory of the Department of Health, New York City, and to Dr. Simon Flexner, Director of The Rockefeller Institute for Medical Research, for their suggestions and criticisms of this work.